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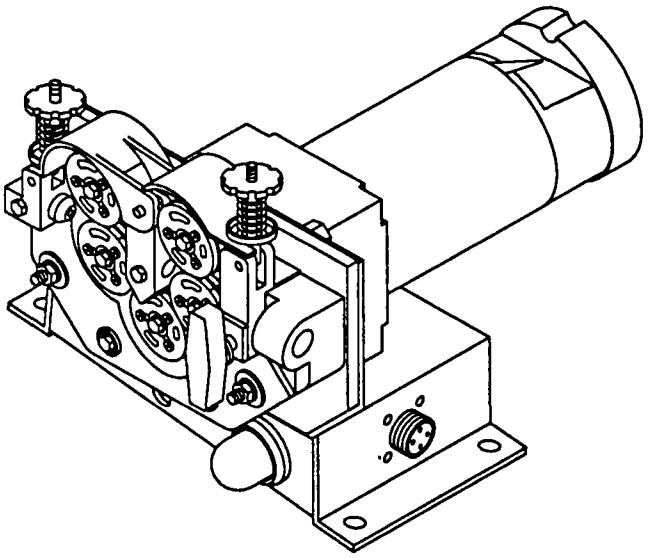
**MODEL: MODEL A1D-4RV**



# OWNER'S MANUAL

**IMPORTANT: Read and understand the entire contents of both this manual and the power source manual used with this unit, with special emphasis on the safety material throughout both manuals, before installing, operating, or maintaining this equipment. This unit and these instructions are for use only by persons trained and experienced in the safe operation of welding equipment. Do not allow untrained persons to install, operate, or maintain this unit. Contact your distributor if you do not fully understand these instructions.**

**MILLER ELECTRIC Mfg. Co.**
A Miller Group Ltd., Company

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PRINTED IN U.S.A

# LIMITED WARRANTY

**EFFECTIVE: FEBRUARY 1, 1990**

This warranty supersedes all previous MILLER warranties and is exclusive with no other guarantees or warranties expressed or implied.

LIMITED WARRANTY – Subject to the terms and conditions hereof, Miller Electric Mfg. Co., Appleton, Wisconsin warrants to its Distributor/Dealer that all new and unused Equipment furnished by Miller is free from defect in workmanship and material as of the time and place of delivery by Miller. No warranty is made by Miller with respect to engines, trade accessories or other items manufactured by others. Such engines, trade accessories and other items are sold subject to the warranties of their respective manufacturers, if any. All engines are warrantied by their manufacturer for two years from date of original purchase, except Deutz engines which have a one year, 2000 hour warranty.

Except as specified below, Miller's warranty does not apply to components having normal useful life of less than one (1) year, such as spot welder tips, relay and contactor points, MILLERMATIC parts that come in contact with the welding wire including nozzles and nozzle insulators where failure does not result from defect in workmanship or material.

Miller shall be required to honor warranty claims on warranted Equipment in the event of failure resulting from a defect within the following periods from the date of delivery of Equipment to the original user:

1. Arc welders, power sources, robots, and components ..... 1 year
2. Load banks ..... 1 year
3. Original main power rectifiers ..... 3 years (labor – 1 year only)
4. All welding guns, feeder/guns and torches .... 90 days
5. All other Millermatic Feeders ..... 1 year
6. Replacement or repair parts, exclusive of labor . 60 days
7. Batteries ..... 6 months

provided that Miller is notified in writing within thirty (30) days of the date of such failure.

As a matter of general policy only, Miller may honor claims submitted by the original user within the foregoing periods.

In the case of Miller's breach of warranty or any other duty with respect to the quality of any goods, the exclusive remedies therefore shall be, at Miller's option (1) repair or (2) replacement or, where authorized in writing by Miller in appropriate cases, (3) the reasonable cost of repair or replacement at an authorized Miller service station or (4) payment of or credit for the purchase price (less reasonable depreciation based upon actual use) upon return of the goods at Customer's risk and expense. MILLER's option of repair or replacement will be F.O.B., Factory at Appleton, Wisconsin, or F.O.B. at a MILLER authorized service facility, therefore, no compensation for transportation costs of any kind will be allowed. Upon receipt of notice of apparent defect or failure, Miller shall instruct the claimant on the warranty claim procedures to be followed.

ANY EXPRESS WARRANTY NOT PROVIDED HEREIN AND ANY IMPLIED WARRANTY, GUARANTY OR REPRESENTATION AS TO PERFORMANCE, AND ANY REMEDY FOR BREACH OF CONTRACT WHICH, BUT FOR THIS PROVISION, MIGHT ARISE BY IMPLICATION, OPERATION OF LAW, CUSTOM OF TRADE OR COURSE OF DEALING, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR PARTICULAR PURPOSE, WITH RESPECT TO ANY AND ALL EQUIPMENT FURNISHED BY MILLER IS EXCLUDED AND DISCLAIMED BY MILLER.

EXCEPT AS EXPRESSLY PROVIDED BY MILLER IN WRITING, MILLER PRODUCTS ARE INTENDED FOR ULTIMATE PURCHASE BY COMMERCIAL/INDUSTRIAL USERS AND FOR OPERATION BY PERSONS TRAINED AND EXPERIENCED IN THE USE AND MAINTENANCE OF WELDING EQUIPMENT AND *NOT* FOR CONSUMERS OR CONSUMER USE. MILLER'S WARRANTIES DO NOT EXTEND TO, AND NO RESELLER IS AUTHORIZED TO EXTEND MILLER'S WARRANTIES TO, ANY CONSUMER.

## RECEIVING-HANDLING

Before unpacking equipment, check carton for any damage that may have occurred during shipment. File any claims for loss or damage **with the delivering carrier**. Assistance for filing or settling claims may be obtained from the distributor and/or the equipment manufacturer's Transportation Department.

When requesting information about this equipment, always provide the Model Description and Serial or Style Number.

Use the following spaces to record the Model Designation and Serial or Style Number of your unit. The information is located on the data card or the nameplate.

Model _____

Serial or Style No. _____

Date of Purchase _____

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# SECTION 1 – SAFETY RULES FOR OPERATION OF ARC WELDING POWER SOURCE

## 1-1. INTRODUCTION

We learn by experience. Learning safety through personal experience, like a child touching a hot stove is harmful, wasteful, and unwise. Let the experience of others teach you.

Safe practices developed from experience in the use of welding and cutting are described in this manual. Research, development, and field experience have evolved reliable equipment and safe installation, operation, and servicing practices. Accidents occur when equipment is improperly used or maintained. The reason for the safe practices may not always be given. Some are based on common sense, others may require technical volumes to explain. It is wiser to follow the rules.

Read and understand these safe practices before attempting to install, operate, or service the equipment. Comply with these procedures as applicable to the particular equipment used and their instruction manuals, for personal safety and for the safety of others.

Failure to observe these safe practices may cause serious injury or death. When safety becomes a habit, the equipment can be used with confidence.

These safe practices are divided into two Sections: 1-General Precautions, common to arc welding and cutting; and 2-Arc Welding (and Cutting) (only).

Reference standards: Published Standards on safety are also available for additional and more complete procedures than those given in this manual. They are listed in the Standards Index in this manual. ANSI Z49.1 is the most complete.

The National Electrical Code, Occupational Safety and Health Administration, local industrial codes, and local inspection requirements also provide a basis for equipment installation, use, and service.

## 1-2. GENERAL PRECAUTIONS

**Different arc welding processes, electrode alloys, and fluxes can produce different fumes, gases, and radiation levels. In addition to the information in this manual, be sure to consult flux and electrode manufacturers Material Safety Data Sheets (MSDSs) for specific technical data and precautionary measures concerning their material.**

### A. Burn Prevention

Wear protective clothing-gauntlet gloves designed for use in welding, hat, and high safety-toe shoes. Button shirt collar and pocket flaps, and wear cuffless trousers to avoid entry of sparks and slag.

Wear helmet with safety goggles and glasses with side shields underneath, appropriate filter lenses or plates (protected by clear cover glass). This is a MUST for welding or cutting, (and chipping) to protect the eyes from radiant energy and flying metal. Replace cover glass when broken, pitted, or spattered. See 1-3A.2.

Avoid oily or greasy clothing. A spark may ignite them.

Hot metal such as electrode stubs and workpieces should never be handled without gloves.

Medical first aid and eye treatment. First aid facilities and a qualified first aid person should be available for each shift unless medical facilities are close by for immediate treatment of flash burns of the eyes and skin burns.

Ear plugs should be worn when working on overhead or in a confined space. A hard hat should be worn when others work overhead.

Flammable hair preparations should not be used by persons intending to weld or cut.

### B. Toxic Fume Prevention

Severe discomfort, illness or death can result from fumes, vapors, heat, or oxygen enrichment or depletion that welding (or cutting) may produce. Prevent them with adequate ventilation as described in ANSI Standard Z49.1 listed in Standards Index. NEVER ventilate with oxygen.

Lead -, cadmium -, zinc -, mercury -, and beryllium-bearing and similar materials, when welded (or cut) may produce harmful concentrations of toxic fumes. Adequate local exhaust ventilation must be used, or each person in the area as well as the operator must wear an air-supplied respirator. For beryllium, both must be used.

Metals coated with or containing materials that emit toxic fumes should not be heated unless coating is removed from the work surface, the area is well ventilated and, if necessary, while wearing an air-supplied respirator.

Work in a confined space only while it is being ventilated and, if necessary, while wearing an air-supplied respirator.

Gas leaks in a confined space should be avoided. Leaked gas in large quantities can change oxygen concentration dangerously. Do not bring gas cylinders into a confined space.

Leaving confined space, shut OFF gas supply at source to prevent possible accumulation of gases in the space if downstream valves have been accidentally opened or left open. Check to be sure that the space is safe before re-entering it.

Vapors from chlorinated solvents can be decomposed by the heat of the arc (or flame) to form PHOSGENE, a highly toxic gas, and other lung and eye irritating products. The ultraviolet (radiant) energy of the arc can also decompose trichloroethylene and perchloroethylene vapors to form phosgene. DO NOT WELD or cut where solvent vapors can be drawn into the welding or cutting atmosphere or where the radiant energy can penetrate

to atmospheres containing even minute amounts of trichloroethylene or perchloroethylene.

### C. Fire and Explosion Prevention

Causes of fire and explosion are: combustibles reached by the arc, flame, flying sparks, hot slag or heated material; misuse of compressed gases and cylinders; and short circuits.

BE AWARE THAT flying sparks or falling slag can pass through cracks, along pipes, through windows or doors, and through wall or floor openings, out of sight of the goggled operator. Sparks and slag can fly 35 feet.

To prevent fires and explosion:

Keep equipment clean and operable, free of oil, grease, and (in electrical parts) of metallic particles that can cause short circuits.

If combustibles are in area, do NOT weld or cut. Move the work if practicable, to an area free of combustibles. Avoid paint spray rooms, dip tanks, storage areas, ventilators. If the work cannot be moved, move combustibles at least 35 feet away out of reach of sparks and heat; or protect against ignition with suitable and snug-fitting, fire-resistant covers or shields.

Walls touching combustibles on opposite sides should not be welded on (or cut). Walls, ceilings, and floor near work should be protected by heat-resistant covers or shields.

Fire watcher must be standing by with suitable fire extinguishing equipment during and for some time after welding or cutting if:

a. appreciable combustibles (including building construction) are within 35 feet

b. appreciable combustibles are further than 35 feet but can be ignited by sparks

c. openings (concealed or visible) in floors or walls within 35 feet may expose combustibles to sparks

d. combustibles adjacent to walls, ceilings, roofs, or metal partitions can be ignited by radiant or conducted heat.

Hot work permit should be obtained before operation to ensure supervisor's approval that adequate precautions have been taken.

After work is done, check that area is free of sparks, glowing embers, and flames.

An empty container that held combustibles, or that can produce flammable or toxic vapors when heated, must never be welded on or cut, unless container has first been cleaned as described in AWS Standard A6.0, listed 7 in Standards Index.

This includes: a thorough steam or caustic cleaning (or a solvent or water washing, depending on the combustible's solubility) followed by purging and inerting with nitrogen or carbon dioxide, and using protective equipment as recommended in A6.0. Waterfilling just below working level may substitute for inerting.

A container with unknown contents should be cleaned (see preceding paragraph). Do NOT depend on sense of smell or sight to determine if it is safe to weld or cut.

Hollow castings or containers must be vented before welding or cutting. They can explode.

Explosive atmospheres. Never weld or cut where the air may contain flammable dust, gas, or liquid vapors (such as gasoline).

### D. Compressed Gas Equipment

Standard precautions. Comply with precautions in this manual, and those detailed in CGA Standard P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, listed 11 in Standards Index.

1. Pressure Regulators

Regulator relief valve is designed to protect only the regulator from overpressure; it is not intended to protect any downstream equipment. Provide such protection with one or more relief devices.

Never connect a regulator to a cylinder containing gas other than that for which the regulator was designed.

Remove faulty regulator from service immediately for repair (first close cylinder valve). The following symptoms indicate a faulty regulator:

Leaks-if gas leaks externally.
Excessive Creep-if delivery pressure continues to rise with downstream valve closed.
Faulty Gauge-if gauge pointer does not move off stop pin when pressurized, nor returns to stop pin after pressure release.

Repair. Do NOT attempt to repair. Send faulty regulators for repair to manufacturer's designated repair center, where special techniques and tools are used by trained personnel.

2. Cylinders

Cylinders must be handled carefully to prevent leaks and damage to their walls, valves, or safety devices:

Avoid electrical circuit contact with cylinders including third rails, electrical wires, or welding circuits. They can produce short circuit arcs that may lead to a serious accident. (See 1-3C.)

ICC or DOT marking must be on each cylinder. It is an assurance of safety when the cylinder is properly handled.

Identifying gas content. Use only cylinders with name of gas marked on them; do not rely on color to identify gas content. Notify supplier if unmarked. NEVER DEFACE or alter name, number, or other markings on a cylinder. It is illegal and hazardous.

Empties: Keep valves closed, replace caps securely; mark MT; keep them separate from FULLS and return promptly.

Prohibited use. Never use a cylinder or its contents for other than its intended use, NEVER as a support or roller.

Locate or secure cylinders so they cannot be knocked over.

Passageways and work areas. Keep cylinders clear of areas where they may be struck.

Transporting cylinders. With a crane, use a secure support such as a platform or cradle. Do NOT lift cylinders off the ground by their valves or caps, or by chains, slings, or magnets.

Do NOT expose cylinders to excessive heat, sparks, slag, and flame, etc. that may cause rupture. Do not allow contents to exceed 130°F. Cool with water spray where such exposure exists.

Protect cylinders particularly valves from bumps, falls, falling objects, and weather. Replace caps securely when moving cylinders.

Stuck valve. Do NOT use a hammer or wrench to open a cylinder valve that can not be opened by hand. Notify your supplier.

Mixing gases. Never try to mix any gases in a cylinder.

Never refill any cylinder.

Cylinder fittings should never be modified or exchanged.

3. Hose

Prohibited use. Never use hose other than that designed for the specified gas. A general hose identification rule is: red for fuel gas, green for oxygen, and black for inert gases.

Use ferrules or clamps designed for the hose (not ordinary wire or other substitute) as a binding to connect hoses to fittings.

No copper tubing splices. Use only standard brass fittings to splice hose.

Avoid long runs to prevent kinks and abuse. Suspend hose off ground to keep it from being run over, stepped on, or otherwise damaged.

Coil excess hose to prevent kinks and tangles.

Protect hose from damage by sharp edges, and by sparks, slag, and open flame.

Examine hose regularly for leaks, wear, and loose connections. Immerse pressured hose in water; bubbles indicate leaks.

Repair leaky or worn hose by cutting area out and splicing (1-2D3). Do NOT tape.

4. Proper Connections

Clean cylinder valve outlet of impurities that may clog orifices and damage seats before connecting regulator. Except for hydrogen, crack valve momentarily, pointing outlet away from people and sources of ignition. Wipe with a clean lintless cloth.

Match regulator to cylinder. Before connecting, check that the regulator label and cylinder marking area, and that the regulator inlet and cylinder outlet match. NEVER CONNECT a regulator designed for a particular gas or gases to a cylinder containing any other gas.

Tighten connections. When assembling threaded connections, clean and smooth seats where necessary. Tighten. If connection leaks, disassemble, clean, and retighten using properly fitting wrench.

Adapters. Use a CGA adapter (available from your supplier) between cylinder and regulator, if one is required. use two wrenches to tighten adapter marked RIGHT and LEFT HAND threads.

Regulator outlet (or hose) connections may be identified by right hand threads for oxygen and left hand threads (with grooved hex on nut or shank) for fuel gas.

5. Pressurizing Steps:

Drain regulator of residual gas through suitable vent before opening cylinder (or manifold valve) by turning adjusting screw in (clockwise). Draining prevents excessive compression heat at high pressure seat by allowing seat to open on pressurization. Leave adjusting screw engaged slightly on single-stage regulators.

Stand to side of regulator while opening cylinder valve.

Open cylinder valve slowly so that regulator pressure increases slowly. When gauge is pressurized (gauge reaches regulator maximum) leave cylinder valve in following position: For oxygen, and inert gases, open fully to seal stem against possible leak. For fuel gas, open to less than one turn to permit quick emergency shutoff.

Use pressure charts (available from your supplier) for safe and efficient, recommended pressure settings on regulators.

Check for leaks on first pressurization and regularly there-after. Brush with soap solution (capfull of Ivory Liquid* or equivalent per gallon of water). Bubbles indicate leak. Clean off soapy water after test; dried soap is combustible.

### E. User Responsibilities

Remove leaky or defective equipment from service immediately for repair. See User Responsibility statement in equipment manual.

### F. Leaving Equipment Unattended

Close gas supply at source and drain gas.

### G. Rope Staging-Support

Rope staging-support should not be used for welding or cutting operation; rope may burn.

*Trademark of Proctor & Gamble.

## 1-3. ARC WELDING

Comply with precautions in 1-1, 1-2, and this section. Arc Welding, properly done, is a safe process, but a careless operator invites trouble. The equipment carries high currents at significant voltages. The arc is very bright and hot. Sparks fly, fumes rise, ultraviolet and infrared energy radiates, weldments are hot, and compressed gases may be used. The wise operator avoids unnecessary risks and protects himself and others from accidents. Precautions are described here and in standards referenced in index.

### A. Burn Protection

Comply with precautions in 1-2.

The welding arc is intense and visibly bright. Its radiation can damage eyes, penetrate lightweight clothing, reflect from light-colored surfaces, and burn the skin and eyes. Skin burns resemble acute sunburn, those from gas-shielded arcs are more severe and painful. DON'T GET BURNED; COMPLY WITH PRECAUTIONS.

1. Protective Clothing

Wear long-sleeve clothing (particularly for gas-shielded arc) in addition to gloves, hat, and shoes (1-2A). As necessary, use additional protective clothing such as leather jacket or sleeves, flame-proof apron, and fire-resistant leggings. Avoid outer garments of untreated cotton.

Bare skin protection. Wear dark, substantial clothing. Button collar to protect chest and neck and button pockets to prevent entry of sparks.

2. Eye and Head Protection

Protect eyes from exposure to arc. NEVER look at an electric arc without protection.

Welding helmet or shield containing a filter plate shade no. 12 or denser must be used when welding. Place over face before striking arc.

Protect filter plate with a clear cover plate.

Cracked or broken helmet or shield should NOT be worn; radiation can pass through to cause burns.

Cracked, broken, or loose filter plates must be replaced IMMEDIATELY. Replace clear cover plate when broken, pitted, or spattered.

Flash goggles with side shields MUST be worn under the helmet to give some protection to the eyes should the helmet not be lowered over the face before an arc is struck. Looking at an arc momentarily with unprotected eyes (particularly a high intensity gas-shielded arc) can cause a retinal burn that may leave a permanent dark area in the field of vision.

3. Protection of Nearby Personnel

Enclosed welding area. For production welding, a separate room or enclosed bay is best. In open areas, surround the operation with low-reflective, non-combustible screens or panels. Allow for free air circulation, particularly at floor level.

Viewing the weld. Provide face shields for all persons who will be looking directly at the weld.

Others working in area. See that all persons are wearing flash goggles.

Before starting to weld, make sure that screen flaps or bay doors are closed.

### B. Toxic Fume Prevention

Comply with precautions in 1-2B.

Generator engine exhaust must be vented to the outside air. Carbon monoxide can kill.

### C. Fire and Explosion Prevention

Comply with precautions in 1-2C.

Equipment's rated capacity. Do not overload arc welding equipment. It may overheat cables and cause a fire.

Loose cable connections may overheat or flash and cause a fire.

Never strike an arc on a cylinder or other pressure vessel. It creates a brittle area that can cause a violent rupture or lead to such a rupture under rough handling.

### D. Compressed Gas Equipment

Comply with precautions in 1-2D.

### E. Shock Prevention

Exposed hot conductors or other bare metal in the welding circuit, or in ungrounded, electrically-HOT equipment can fatally shock a person whose body becomes a conductor. DO NOT STAND, SIT, LIE, LEAN ON, OR TOUCH a wet surface when welding, without suitable protection.

To protect against shock:

Wear dry insulating gloves and body protection. Keep body and clothing dry. Never work in damp area without adequate insulation against electrical shock. Stay on a dry duckboard, or rubber mat when dampness or sweat can not be avoided. Sweat, sea water, or moisture between body and an electrically HOT part or grounded metal reduces the electrical resistance, and could enable dangerous and possibly lethal currents to flow through the body.

A voltage will exist between the electrode and any conducting object in the work circuit. Examples of conducting objects include, but are not limited to, buildings, electrical tools, work benches, welding power source cases, workpieces, etc. **Never touch the electrode and any metal object unless the welding power source is off.**

1. Grounding the Equipment

Arc welding equipment must be grounded according to the National Electrical Code, and the work must be grounded according to ANSI Z49.1 "Safety In Welding And Cutting."

When installing, connect the frames of each unit such as welding power source, control, work table, and water circulator to the building ground. Conductors must be adequate to carry ground currents safely. Equipment made

electrically HOT by stray current may shock, possibly fatally. Do NOT GROUND to electrical conduit, or to a pipe carrying ANY gas or flammable liquid such as oil or fuel.

Three-phase connection. Check phase requirements of equipment before installing. If only 3-phase power is available, connect single-phase equipment to only two wires of the 3-phase line. Do NOT connect the equipment ground lead to the third (live) wire, or the equipment will become electrically HOT-a dangerous condition that can shock, possibly fatally.

Before welding, check ground for continuity. Be sure conductors are touching bare metal of equipment frames at connections.

If a line cord with a ground lead is provided with the equipment for connection to a switchbox, connect the ground lead to the grounded switchbox. If a three-prong plug is added for connection to a grounded mating receptacle, the ground lead must be connected to the ground prong only. If the line cord comes with a three-prong plug, connect to a grounded mating receptacle. Never remove the ground prong from a plug, or use a plug with a broken off ground prong.

2. Electrode Holders

Fully insulated electrode holders should be used. Do NOT use holders with protruding screws.

3. Connectors

Fully insulated lock-type connectors should be used to join welding cable lengths.

4. Cables

Frequently inspect cables for wear, cracks and damage. IMMEDIATELY REPLACE those with excessively worn or damaged insulation to avoid possibly-lethal shock from bared cable. Cables with damaged areas may be taped to give resistance equivalent to original cable.

Keep cable dry, free of oil and grease, and protected from hot metal and sparks.

5. Terminals And Other Exposed Parts

Terminals and other exposed parts of electrical units should have insulating covers secured before operation.

6. Electrode

   a. Equipment with output on/off control (contactor)

      Welding power sources for use with the gas metal arc welding (GMAW), gas tungsten arc welding (GTAW) and similar processes normally are equipped with devices that permit on-off control of the welding power output. When so equipped the electrode wire becomes electrically HOT when the power source switch is ON and the welding gun switch is closed. Never touch the electrode wire or any conducting object in contact with the electrode circuit unless the welding power source is off.

   b. Equipment without output on/off control (no contactor)

      Welding power sources used with shielded metal arc welding (SMAW) and similar processes may not be equipped with welding power output on-off control devices. With such equipment the electrode is electrically HOT when the power switch is turned ON. Never touch the electrode unless the welding power source is off.

7. Safety Devices

Safety devices such as interlocks and circuit breakers should not be disconnected or shunted out.

Before installation, inspection, or service, of equipment, shut OFF all power and remove line fuses (or lock or red-tag switches) to prevent accidental turning ON of power. Disconnect all cables from welding power source, and pull all 115 volts line-cord plugs.

Do not open power circuit or change polarity while welding. If, in an emergency, it must be disconnected, guard against shock burns, or flash from switch arcing.

Leaving equipment unattended. Always shut OFF and disconnect all power to equipment.

Power disconnect switch must be available near the welding power source.

### F. Protection For Wearers of Electronic Life Support Devices (Pacemakers)

Magnetic fields from high currents can affect pacemaker operation. Persons wearing electronic life support equipment (pacemaker) should consult with their doctor before going near arc welding, gouging, or spot welding operations.

## 1-4. STANDARDS BOOKLET INDEX

For more information, refer to the following standards or their latest revisions and comply as applicable:

1. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126.
2. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
3. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY-TOE FOOTWEAR obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.
6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES

obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126.
8. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING, CUTTING, AND ALLIED PROCESSES obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.
9. NFPA Standard 70, NATIONAL ELECTRICAL CODE obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.
10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.
11. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202.
12. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.
13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103.
14. American Welding Society Standard AWSF4.1, RECOMMENDED SAFE PRACTICES FOR THE PREPARATION FOR WELDING AND CUTTING OF CONTAINERS AND PIPING THAT HAVE HELD HAZARDOUS SUBSTANCES, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126.
15. ANSI Standard Z88.2, PRACTICE FOR RESPIRATORY PROTECTION, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

## SECTION 2 – SAFETY PRECAUTIONS AND SIGNAL WORDS

### 2-1. GENERAL INFORMATION AND SAFETY

#### A. General

Information presented in this manual and on various labels, tags, and plates on the unit pertains to equipment design, installation, operation, maintenance, and troubleshooting which should be read, understood, and followed for the safe and effective use of this equipment.

The nameplate of this unit uses international symbols for labeling the front panel controls. The symbols also appear at the appropriate section in the text.

#### B. Safety

The installation, operation, maintenance, and troubleshooting of arc welding equipment requires practices and procedures which ensure personal safety and the safety of others. Therefore, this equipment is to be installed, operated, and maintained only by qualified persons in accordance with this manual and all applicable codes such as, but not limited to, those listed at the end of Section 1 – Safety Rules For Operation Of Arc Welding Power Source.

### 2-2. SAFETY ALERT SYMBOL AND SIGNAL WORDS

The following safety alert symbol and signal words are used throughout this manual to call attention to and identify different levels of hazard and special instructions.

This safety alert symbol is used with the signal words WARNING and CAUTION to call attention to the safety statements.

**WARNING** statements identify procedures or practices which must be followed to avoid serious personal injury or loss of life.

**CAUTION** statements identify procedures or practices which must be followed to avoid minor personal injury or damage to this equipment.

**IMPORTANT** *statements identify special instructions necessary for the most efficient operation of this equipment.*

# SECTION 3 – SPECIFICATIONS

**Table 3-1. Specifications**

| Speed Range Per Minute | Electrode Wire Diameter Capacity | Dimensions | Weight |
|---|---|---|---|
| 50 to 780 in. (1.3 to 19.8m) | .030 thru 1/8 in. (0.8 thru 3.2mm) | Height 8 7/8 in. (225 mm) Width 12 3/4 in. (324 mm) Length 9 3/8 in. (238mm) | 18 lbs (7.85 kg) |

## 3-1. DESCRIPTION

The A1D-4RV wire drive assembly is designed for use with the MRV-6 arc welding robot. This is a four drive roll unit with a mounting bracket. The drive assembly is factory installed onto the robot arm and functions as an integral part of the robot welding system.

# SECTION 4 – INSTALLATION

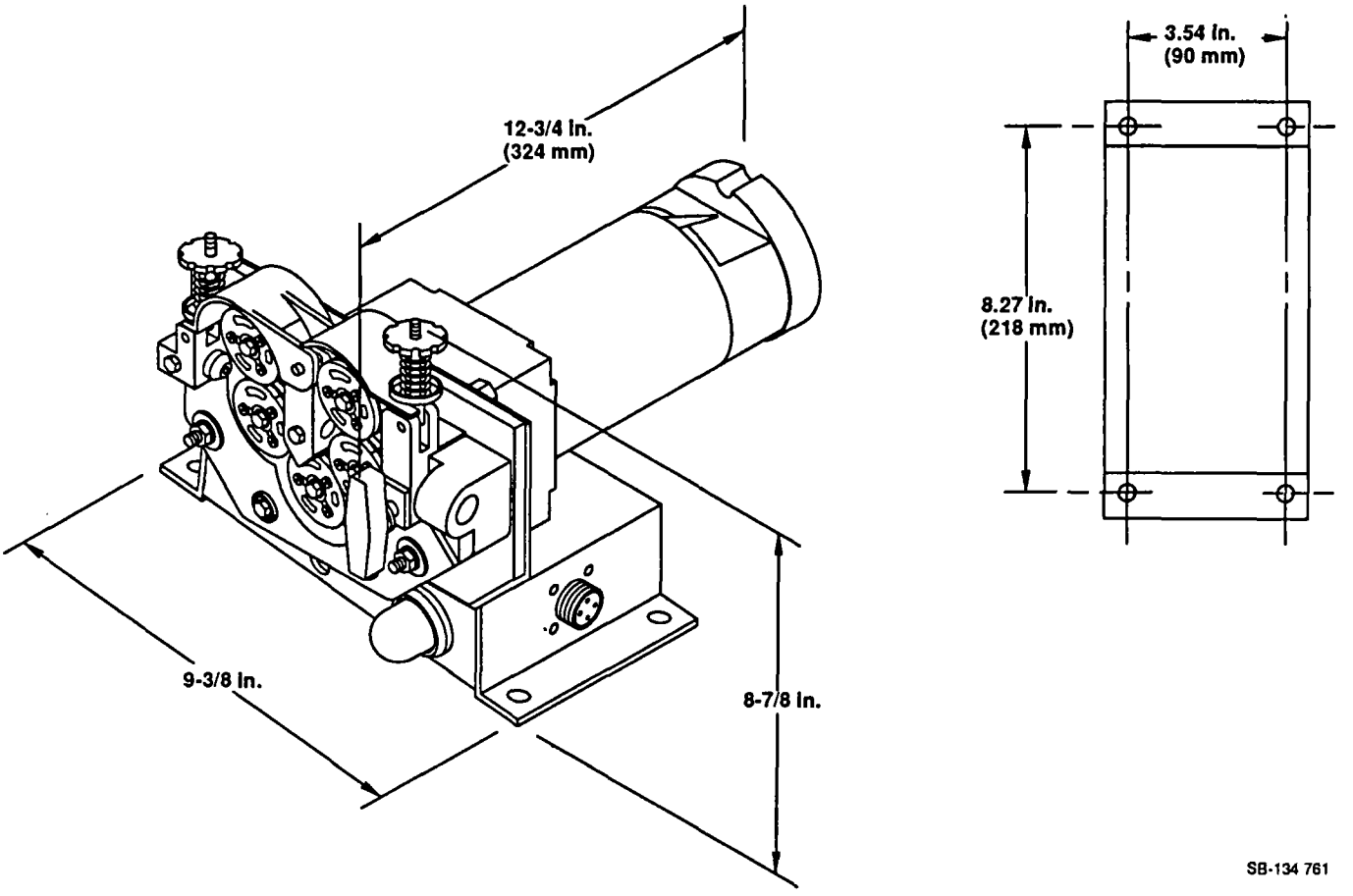



**Figure 4-1. Overall Dimensions And Mounting Hole Layout**

## 4-1. LOCATION (Figure 4-1)

The service life and efficiency of this unit and associated components are reduced when they are subjected to high levels of dust, dirt, moisture, corrosive vapors, and extreme heat.

The drive assembly is factory installed onto the robot. Figure 4-1 gives overall dimensions and mounting hole layouts.

## 4-2. DRIVE MOTOR

**CAUTION: LOSS OF GEAR OIL OR DIRT ENTERING GEAR CASE WILL DAMAGE MOTOR.**

- *The gear case of the drive motor is equipped with two vent screws. Do not remove or discard the vent screws before operation.*

## 4-3. WIRE GUIDE AND DRIVE ROLL INSTALLATION FOR 4-DRIVE ROLL MODELS

Upon initial installation, or as a result of changes in wire size and type, it is necessary to install the required wire guides and drive rolls.

**IMPORTANT:** *Base selection of drive rolls upon the following recommended usages:*

1. V-Groove rolls for hard wire.
2. U-Groove rolls for soft and soft shelled cored wires.
3. U-Cog rolls for extremely soft shelled wires (usually hard surfacing types).
4. Split V-Knurled rolls for hard shelled cored wires (self-shielding and CO2 shielded types).
5. Drive roll types may be mixed to suit particular requirements (example: V-knurled roll in combination with U-groove).

Having selected the appropriate wire guides and drive rolls, proceed to the following installation instructions:

### A. Wire Guides (Figure 4-2)

1. Loosen the inlet and intermediate wire guide securing screws.

**IMPORTANT:** *Wire guides should be installed so that the tip(s) of the guide is as close to the drive roll as possible without touching. Recheck wire guides after drive rolls are installed, and adjust if necessary.*

2. Install inlet and intermediate wire guides as illustrated in Figure 4-2. Secure by tightening securing screws.

**IMPORTANT**: *The alignment of the motor drive gear with the drive roll gears has been factory set, but if readjustment becomes necessary, proceed as follows: Behind the motor drive gear (see Figure 4-2) is a spring washer(s). To obtain proper alignment of the motor gear with the drive roll gears, rotate the motor gear securing bolt thereby moving the gear in or out to the desired position.*

**IMPORTANT:** *The wire drive housing is made with mounting holes of sufficient clearance to provide adjustment of the housing up or down in relation to the motor drive gears. This adjustment has been factory set, but if readjustment becomes necessary, loosen mounting bolts, weld terminal nuts and bolts. Slide the wire drive housing upward or downward until the gears on the housing have a slight amount of clearance (backlash) from the motor gear. Tighten mounting bolts, weld terminal bolts and nuts.*

**IMPORTANT**: *Proper clearance between the steel gears is important. The proper clearance is 0.003 inch (0.076 mm). This is approximately the same thickness as a sheet of standard writing paper. The easiest way to obtain the proper alignment is to insert a piece of 0.003 in. (0.076mm) thick standard writing paper between the motor and drive roll, and then tighten down the drive roll assembly. If This proper clearance is not maintained in the in the gears, they may wear severely, bind, cause erratic wire feed, or break.*

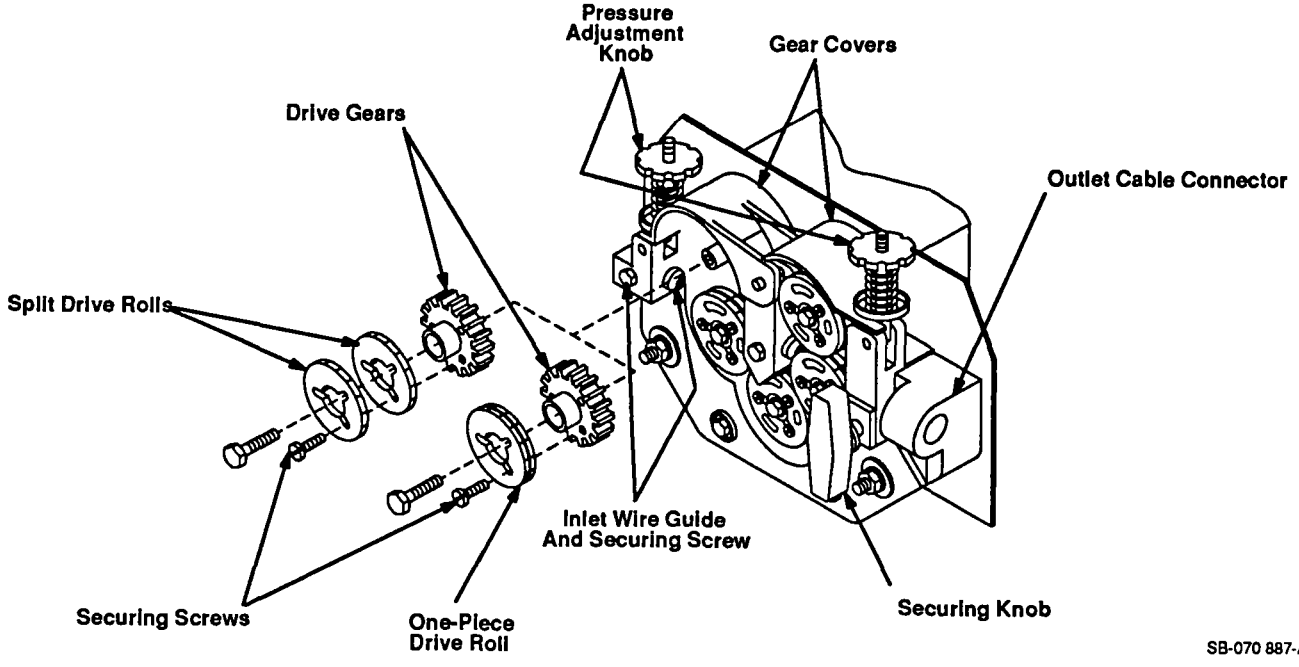



**Figure 4-2. Wire Guide And Drive Roll Installation**

### B. One-Piece Drive Roll (Figure 4-2 and 4-3)

**IMPORTANT:** *One-piece drive rolls are of the double usage type. When the grooves become worn, reverse each drive roll, locating the unused groove in position to feed the wire.*

1. Loosen pressure adjustment knobs and pivot them free of the covers.
2. Pivot gear covers away to expose pressure gears.
3. Loosen and remove the three securing screws on each gear.
4. Slide a drive roll onto each drive gear and pressure gear, align holes, and secure with screws.

**IMPORTANT:** *To ensure proper gripping action of U-Cog drive rolls, both rolls should be installed showing slots on the side or both should show the side without slots. Also, it is necessary to line up the blunted teeth on the pressure gear roll directly over the spaces between the teeth on the drive roll (see Figure 4-3).*

### C. Split Drive Roll (Figure 4-2)

**IMPORTANT:** *Split drive rolls are of the double usage type. When the knurled groove of the drive rolls becomes worn, the split halves can be reversed so that the unused edges provide a new knurled groove.*

1. Loosen pressure adjustment knobs and pivot them free of the covers.
2. Pivot gear covers away to expose pressure gears.
3. Loosen and remove the three securing screws on each gear.
4. Align holes on each pair of split drive rolls, insert a securing screw and slide a pair of drive rolls onto each drive gear and pressure gear keeping screw in line with one of the threaded holes. Insert remaining screws and tighten.

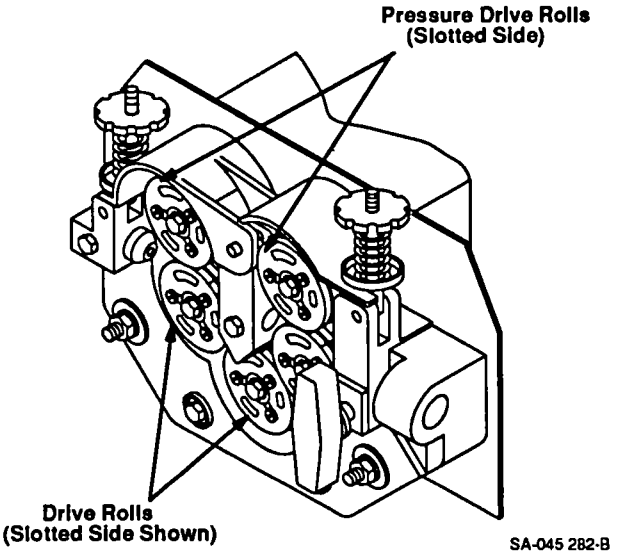



**Figure 4-3. U-Cog Drive Roll Installation**

### 4-4. OUTLET CABLE CONNECTIONS (Figure 4-2)

1. Loosen the outlet cable connector securing knob.

**IMPORTANT:** *Wire guides should be installed so that the tip of the guide is as close to the drive roll as possible without touching.*

2. Insert the outlet cable connector, which includes the installed outlet guide, into the drive assembly opposite the inlet guide.
3. Tighten the outlet cable connector securing knob.
4. Connect the 4-pin plug from outlet cable to the 4-socket receptacle on the motor mounting bracket.

### 4-5. DRIVE MOTOR CONNECTIONS

Make connections according to instructions in the installation section of robot Owner's Manual.

## SECTION 5 – SEQUENCE OF OPERATION

### 5-1. WELDING WIRE THREADING

**WARNING: ELECTRIC SHOCK can kill. WELDING WIRE can cause puncture wounds.**

- *Do not touch live electrical parts.*
- *Do not energize welding power source and robot control until instructed to do so.*
- *Do not point gun toward any part of the body, any conductive surface, or other personnel when threading welding wire.*

The welding wire and all metal parts in contact with it are energized while welding.

1. Connect the gun to the drive motor assembly.
2. Install the wire (reel-type or spool-type) as instructed in the robot Owner's Manual.
3. Loosen the knob(s) on the drive roll pressure adjustment(s), pivot the pressure adjustment(s) free of the cover(s), and pivot the pressure gear assembly(ies) away to an open position.

**IMPORTANT:** *Spooled wire has a tendency to unravel when loosened from the spool. Maintain a firm grip on the wire during the threading operation.*

4. Cut off any portion of the free end of the wire which is not straight. If necessary, straighten wire to remove cast. Be sure that the cut end is free from rough surfaces to permit proper feeding.

5. Feed the wire through the inlet wire guide (and intermediate guide, if applicable). past the drive rolls, and on into the outlet wire guide. Feed approximately 4 in. (102 mm) of wire into the outlet wire guide.

6. Pivot the pressure gear assembly(ies) closed making sure the teeth on the pressure gear mesh with the teeth on the drive gear. The welding wire must also be in the grooves of the drive rolls.

7. Pivot the pressure adjustment knob(s) until the washer(s) on the pressure adjustment(s) is seated on top of the cover(s).

8. Turn the pressure adjustment knob(s) in clockwise direction until the drive rolls are tight against the welding wire. Do not overtighten. Further adjustment to attain desired clamping pressure can be made after the welding power source and the weld control are put into operation.

9. Energize the welding power source.

**IMPORTANT:** *See robot Owner's Manual for wire inching procedures.*

## SECTION 6 – MAINTENANCE

**IMPORTANT:** *Every six months inspect the labels on this unit for legibility. All precautionary labels must be maintained in a clearly readable state and replaced when necessary. See Parts List for part number of precautionary labels.*

**WARNING: ELECTRIC SHOCK can kill; MOVING PARTS can cause injury; WELDING WIRE can cause puncture wounds; HOT SURFACES can burn skin.**

- *Do not touch live electrical parts.*
- *Disconnect input power to the drive motor and shut down the welding power source and robot before inspecting or servicing.*
- *Allow components to cool before servicing.*

### 6-1. INSPECTION AND UPKEEP

Usage and shop conditions will determine the frequency and type of maintenance. Inspect equipment as follows:

1. Make sure welding power source and robot is shut down.

2. Inspect gun and outlet cable for broken areas, cracks and loose parts; tighten, repair, and replace as required.

3. Carefully remove any weld spatter or foreign matter which may accumulate around the nozzle orifice. Use a hardwood stick, never a metal tool.

4. Repair or replace, as required, all hose and cable; give particular attention to frayed and cracked insulation and areas where it enters equipment.

5. Remove grease and grime from components; moisture from electrical parts and cable.

6. Blow out the gun wire guide liner with compressed air when changing wire. This will remove any metal chips and dirt that may have accumulated.

### 6-2. CLEANING OF DRIVE ROLLS

Occasionally it will become necessary to clean the wire groove on the drive rolls. This cleaning operation can be performed with a wire brush.

**WARNING: Read and follow safety information at beginning of entire Section 6-1 before proceeding.**

To clean the wire grooves, disconnect input power from unit before removing the drive roll(s) and see Sections 3-3 and 3-4 for removal and installation instructions.

**WARNING: HIGH ROTATIONAL SPEED may cause damage to drive rolls and injure personnel.**

- *Do not allow drive rolls to rotate at high speed if compressed air is used for cleaning the drive roll assembly.*

**IMPORTANT:** *Failure to properly maintain the drive rolls can result in a buildup of wire particles which will decrease the efficiency of the wire feeding operation.*

### 6-3. BRUSH INSPECTION & REPLACEMENT (Figures 6-1 and 6-2)

The brushes should be inspected periodically depending on usage and conditions.

**WARNING: Read and follow safety information at beginning of entire Section 6-1 before proceeding.**

1. Shut down unit and associated equipment.

2. Open brush cap by sliding screwdriver under catch and lifting. Remove brush cap.

3. Grasp spring retaining bracket with long-nose pliers.

4. Push spring retaining bracket in slightly and move towards brush. This should release the spring assembly and it can be removed.

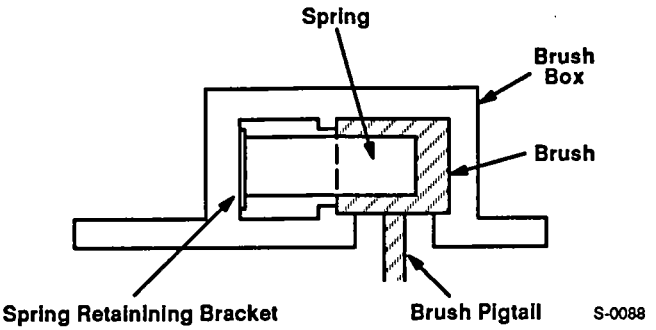



**Figure 6-1. View Of Spring Assembly And Brush When Brush Cap Is Opened**

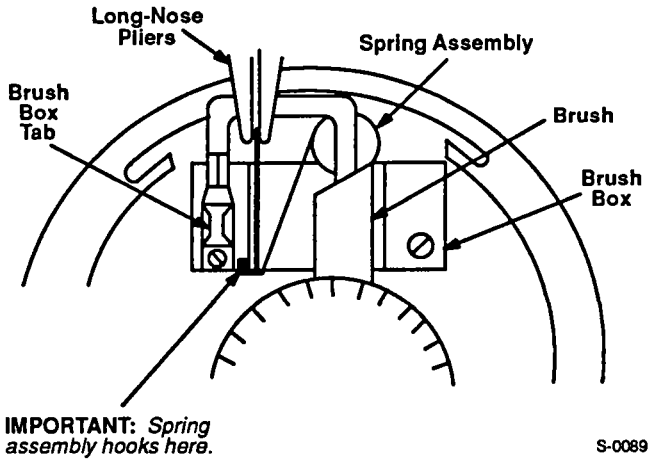



**Figure 6-2. View Of Spring Assembly And Brush From Armature End Of Motor**

5. Pull brush out using brush pigtail.
6. If replacement is necessary (brushes are less than 1/4 in. or 6.4 mm in length) disconnect the brush pigtail from the brush box tab and remove brush.
7. Connect new brush pigtail to brush box tab.
8. Route pigtail through slot in brush box. Ensure that the pigtail will not come into contact with a metal surface.
9. Insert brush into brush box. Ensure that the low end of the bevel on the top of the brush is towards the spring.
10. Using long-nose pliers, insert spring assembly beside brush sliding the spring retaining bracket along the brush box wall. The spring retaining bracket hooks on the brush box wall as illustrated in Figure 6-2.
11. If the spring retaining bracket is in place, it will be against the brush box wall when the pliers are released.
12. Ensure that the spring is in the proper position as illustrated in Figures 6-1 and 6-2.
13. Replace and latch the brush cap.
14. Reconnect power to all equipment and resume operation.

## SECTION 7 – TROUBLESHOOTING

**IMPORTANT:** *Every six months inspect the labels on this unit for legibility. All precautionary labels must be maintained in a clearly readable state and replaced when necessary. See Parts List for part number of precautionary labels.*

### 7-1. GENERAL

It is assumed that proper installation has been made, according to Section 4 of this manual, and that the unit has been functioning properly until trouble developed.

### 7-2. TROUBLESHOOTING CHART

**WARNING: ELECTRIC SHOCK can kill.**

- *Do not touch live electrical parts.*
- *Shut down unit, welding power source, and robot, and disconnect input power employing lockout/tagging procedures before inspecting or servicing.*

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

Troubleshooting to be performed only be qualified persons.

The following chart is designed to diagnose and provide remedies for some of the troubles that may develop in this unit.

Use this chart in conjunction with the instructions in this manual while performing troubleshooting procedures. If the trouble is not remedied after performing these procedures, the nearest Factory Authorized Service Station should be contacted. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly followed.

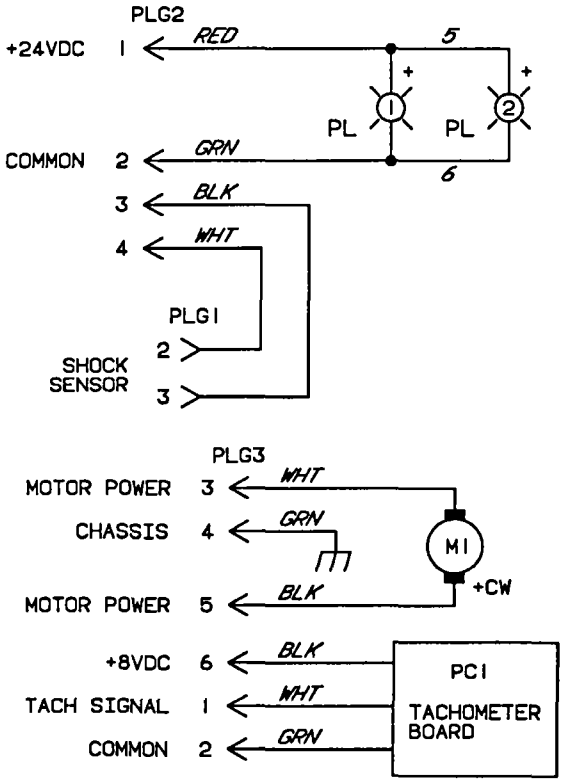
**CAUTION: DISASSEMBLY OF MOTOR FIELD MAGNETS can result in personal injury and equipment damage.**

- *Limit drive motor repairs to brush replacement.*

The field magnets are very strong. If disassembly is attempted, injury to fingers and hands may result from a magnet being drawn back into the motor. The field magnets are matched sets and operation may be affected if the magnets are tampered with. Warranty is void if the motor is tampered with.

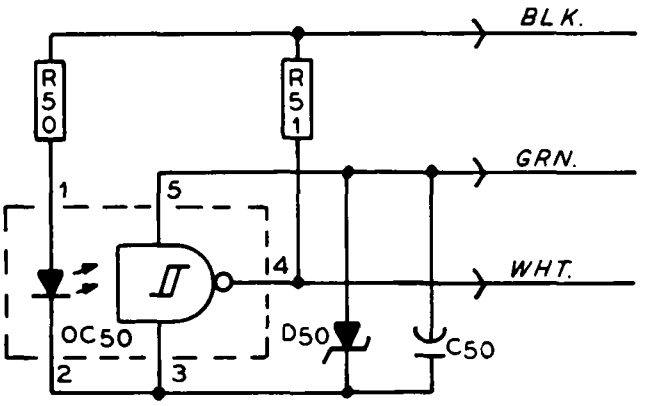
**Table 7-1. Troubleshooting**

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Wire Feeds erratically. | Obstruction in gun contact tube. | Clear obstruction. |
| | Drive motor plug not secure to cord plug. | Secure plug connection. |
| | Incorrect pressure on drive rolls. | Rotate pressure adjustment knob(s) clockwise in 1/4 turn increments until wire slippage stops. If excess pressure is required, check outlet cable and gun contact tube for obstructions. |
| | Drive roll is too large for wire size being used. | Change to proper size drive roll (see Sections 4-3). |
| | Worn drive roll. | Replace drive roll (see Sections 4-3). |
| | Dirt in drive roll. | Clean drive roll as instructed in Section 6-2. |
| | Incorrect hub tension. | Readjust hub tension (see robot Owner's Manual. |
| Wire stops feeding while welding. | Drive rolls misaligned. | Realign drive rolls (see Section 4-3). |
| | Motor. | Replace motor. |
| Operations Module servo light on, Program Module display on, motor servo light(s) off. | Burned out motor servo light(s). | Check and replace motor servo light(s) PL1 and/or PL2. |
| | Loose servo light connection | Secure servo light connection (see robot Owner's Manual. |




**Circuit Diagram No. SA-134 193-A**

**Diagram 8-1. Circuit Diagram**




**Circuit Diagram No. A-094 456**

**Diagram 8-2. Circuit Diagram For Tach Board PC1**

# SECTION 9 – PARTS LIST

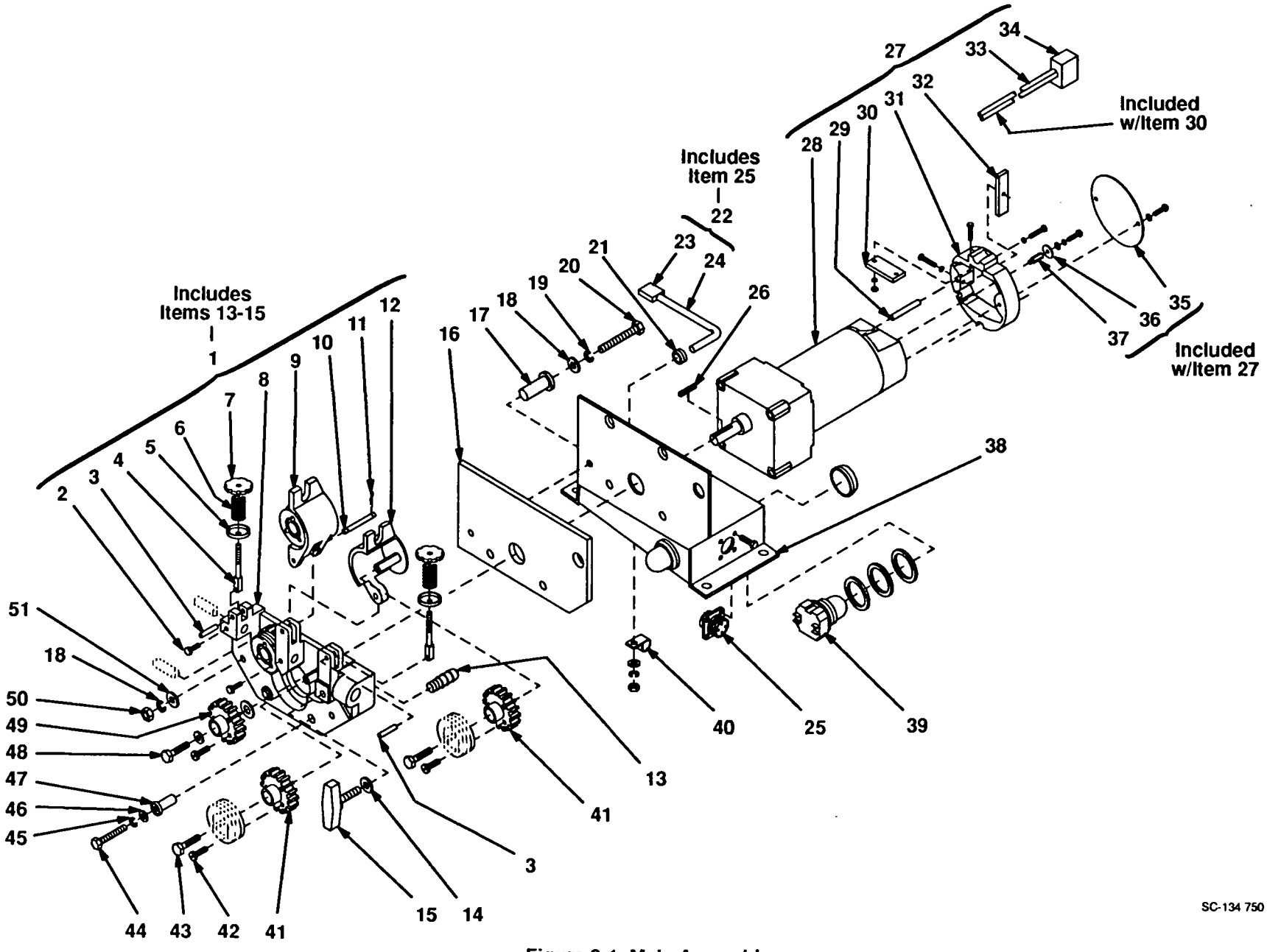



Figure 9-1. Main Assembly

| Item No. | Dia. Mkgs. | Part No. | Description | Quantity |
|---|---|---|---|---|
| | | | **Figure 9-1. Main Assembly** | |
| 1 | | 046 779 | DRIVE ASSEMBLY, (consisting of) | 1 |
| 2 | | 601 925 | · SCREW, cap stl hexhd .250-20 | 2 |
| 3 | | 010 224 | · PIN, spring CS .187 x 1.000 | 2 |
| 4 | | 085 242 | · FASTENER, pinned | 2 |
| 5 | | 085 244 | · WASHER, cupped stl .328 ID x .812 OD | 2 |
| 6 | | 010 231 | · SPRING, cprsn .770 OD x .105 wire | 2 |
| 7 | | 085 243 | · KNOB, adjustment tension | 2 |
| 8 | | 046 621 | · HOUSING, adapter gun/feeder | 1 |
| 9 | | 079 669 | · LEVER, mtg pressure gear | 1 |
| 10 | | 079 634 | · PIN, hinge | 1 |
| 11 | | 604 741 | · PIN, cotter hair .042 x .937 | 1 |
| 12 | | 046 619 | · LEVER, mtg pressure gear | 1 |
| 13 | | 079 633 | · FITTING, hose brs barbed nipple 3/16tbg | 1 |
| 14 | | 604 538 | · WASHER, flat stl sae .312 | 1 |
| 15 | | 079 772 | · KNOB, plstc T 1.500lg x .312-18 | 1 |
| 16 | | 134 177 | INSULATOR, drive assy | 1 |
| 17 | | 075 150 | WASHER, shldr nyl 1.000 OD x .375 ID | 1 |
| 18 | | 010 910 | WASHER, flat stl SAE .375 | 1 |
| 19 | | 602 213 | WASHER, lock stl split .375 | 2 |
| 20 | | 079 624 | SCREW, cap stl hexhd slf lkg .375-16 x 2.250 | 1 |
| 21 | | 010 116 | GROMMET, rbr .375 ID x .500 mtg hole | 1 |
| 22 | | 134 171 | CABLE, shock sensor & lights (consisting of) | 1 |
| 23 | PLG2 | 134 860 | · HOUSING PLUG & PINS, (consisting of) | 1 |
| | | 134 184 | · · TERMINAL, male 1 pin .051dia 20-16 wire | 4 |
| 24 | | 604 571 | · CABLE, port No. 18 4/c (order by ft) | 1ft |
| 25 | PLG1 | 048 282 | · RECEPTACLE w/SOCKETS, (consisting of) | 1 |
| | | 079 534 | · · TERMINAL, female 1skt 14-18 wire | 4 |
| 26 | | 092 865 | KEY, stl .122/.123 x .750 | 1 |
| 27 | | 134 156 | MOTOR, gear (consisting of) | 1 |
| 28 | | 080 802 | · MOTOR, gear 1/8hp 115VDC 2000RPM | 1 |
| 29 | | 049 033 | · SPACER, housing tachometer | 1 |
| 30 | | 134 157 | · CIRCUIT CARD, tachometer (consisting of) | 1 |
| | C50 | 073 739 | · · CAPACITOR, cer mono .1uf 50VDC | 1 |
| | D50 | 094 934 | · · DIODE, zener 5.1V 400MW | 1 |
| | OC50 | 094 268 | · · IC, interface 973N51 | 1 |
| | R50 | 052 140 | · · RESISTOR, C .5W 330 ohm | 1 |
| | R51 | 039 328 | · · RESISTOR, CF .25W 1.5K ohm | 1 |
| | | 134 170 | · · CABLE, tach 15.000 in. | 1 |
| 31 | | 049 029 | · HOUSING, tachometer feedback | 1 |
| 32 | | 049 032 | · CLAMP, strain relief | 1 |
| 33 | | 007 826 | · CABLE, port No. 18 3/c (order by ft) | 2ft |
| 34 | PLG3 | 134 858 | · HOUSING PLUG & PINS, (consisting of) | 1 |
| | | 134 184 | · · TERMINAL, male 1 pin .051dia 20-16 wire | 6 |
| 35 | | 049 030 | · COVER, housing tachometer feedback | 1 |
| 36 | | 110 733 | · OPTICAL ENCODER, disc | 1 |
| 37 | | 049 031 | · SHAFT, extension armature | 1 |
| 38 | | 134 176 | BRACKET, mtg motor | 1 |
| 39 | PL1,2 | 117 160 | PILOT LAMP, (consisting of) | 2 |
| | | *115 276 | · BULB, LED red 28V min bayonet | 1 |
| 40 | | 010 142 | CLAMP, nyl .312dia | 1 |
| 41 | | 053 842 | GEAR, spur insulated w/bearing | 4 |
| 42 | | 079 626 | SCREW, mach stl filh 10-32 | 15 |
| 43 | | 605 518 | SCREW, cap stl hexhd .250-20 | 4 |

| Item No. | Dia. Mkgs. | Part No. | Description | Quantity |
|---|---|---|---|---|
| | | | **Figure 9-1. Main Assembly** | |
| 44 | | 044 735 | SCREW, cap stl hexhd .250-28 | 2 |
| 45 | | 602 207 | WASHER, lock stl split .250 | 2 |
| 46 | | 602 241 | WASHER, flat stl SAE .250 | 3 |
| 47 | | 072 010 | WASHER, shldr nyl .437 OD x .316 ID | 2 |
| 48 | | 000 418 | SCREW, cap stl hexhd slflkg .250-20 | 1 |
| 49 | | 093 664 | GEAR, spur insulated drive | 1 |
| 50 | | 601 872 | NUT, stl hex full fnsh .375-16 | 1 |
| 51 | | 602 243 | WASHER, flat stl .375 | 1 |